# Prospective Analysis of Psychiatric Risk Factors in Marines Sent to War

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# Prospective Analysis of Psychiatric Risk Factors in Marines Sent to War

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**ABSTRACT** The objective of this longitudinal study was to identify risk factors for combat-related psychiatric disorders. The sample consisted of 6,442 enlisted U.S. Marines who completed a questionnaire during basic training, deployed to a combat zone with no prior psychiatric diagnoses, and completed a postdeployment assessment form. Cox proportional hazards regression was used to determine associations between predeployment and postdeployment self-reports and subsequent mental health outcomes. During the observation period, 6.8% of the sample were diagnosed with a psychiatric disorder. The strongest predictors of postdeployment psychiatric disorders were, in order of importance, low paygrade, hospitalization during deployment, low education, preservice smoking, and post-traumatic stress disorder symptoms at deployment's end. The impact of war zone variables was smaller than expected. It was recommended that the combat experience section of the military's postdeployment assessment form be expanded to enhance the military's ability to identify and refer personnel who may be at risk for psychiatric disorders.

## INTRODUCTION

Extensive research indicates that military war zone experiences, like other forms of violence or trauma, heighten the likelihood of psychiatric disorders.[1-7] However, research on risk factors for combat-related psychiatric disorders has relied heavily on retrospective accounts of important predictor variables such as war zone experiences and levels of psychological distress, sometimes obtained years after returning from a war zone.

The ability of combat veterans to accurately reconstruct traumatic events is subject to debate, and substantial instability in trauma memories has been reported by researchers.[8-10] For example, Roemer and colleagues obtained frequency estimates of exposure to war-zone stressors at two time points from 460 U.S. soldiers who had served in the peacekeeping mission in Somalia.[8] On average, soldiers demonstrated a significant increase in their frequency reports from initial (postdeployment) to follow-up assessment. Similarly, a study of National Guard reservists who were assigned to the Persian Gulf during Operation Desert Storm compared veterans' questionnaire responses a month after coming home and again nearly 2 years later, and found that 70% of participants recalled an event at the 2-year assessment that they had not reported at the 1-month assessment.[10] Subjects with a higher level of PTSD symptoms were significantly more likely to inflate their memory of combat trauma at the 2-year assessment than those with fewer symptoms. These studies raise the possibility that traumatized veterans may unintentionally distort or exaggerate their war zone experiences to help explain their symptoms, which calls into question the ability of trauma victims to accurately reconstruct critical events.[11]

Memory bias associated with psychological distress is of course not limited to military populations. For example, Safer and Keuler asked clients who were terminating psychotherapy to complete a measure of symptomatic distress exactly as they had in their pretherapy assessment.[9] Most clients overestimated their pretherapy distress, which may lead to an illusion of positive change. The degree of overestimation for psychotherapy clients was positively correlated with anxiety, depression, and neuroticism. Moreover, memory distortions are but one example of cognitive biases in clinical populations.[12] The existence of these biases makes it imperative that epidemiological research on mental disorders (both military and civilian) be based on longitudinal data whenever possible.

The objective of this longitudinal study was to determine associations of both predeployment and postdeployment self-reports with mental health outcomes in a sample of enlisted Marines who were deployed to combat zones.

## METHOD

### Overview

The longitudinal database created for this study was compiled from (1) Recruit Assessment Program (RAP) questionnaire data; (2) Post-Deployment Health Assessment (PDHA) data; and (3) demographic, personnel, and medical diagnoses data from the Career History Archival Medical and Personnel System (CHAMPS). This resulted in a study database for a

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sample of 6,442 enlisted Marines who had completed at least one combat deployment. Using this combined database, Cox proportional hazards regression (survival analysis) was used to determine predictors of developing a mental health disorder during a 43-month (maximum) observation period.

## Measures

### RAP Questionnaire

The RAP questionnaire is a self-administered instrument that assesses Marine recruits' medical and psychosocial histories. It was developed by officials from the Department of Defense (DoD) and other government agencies to evaluate the health effects of military service. Since June 2001, the RAP questionnaire has been administered to the vast majority (>99%) of Marine recruits trained in San Diego at the start of basic training. Because only male recruits are trained in San Diego, RAP data are collected for male recruits only.

Most of the RAP questions were derived or adapted from other survey instruments, including the SF-36 Health Survey,[13] the Adverse Childhood Experiences Study,[14,15] the Conflict Tactics Scales,[16] and the Alcohol Use Disorders Identification Test (AUDIT).[17] Since June 2001, four different versions of the RAP questionnaire have been in use.

The following RAP domains were included as predictors on the basis of correlations in the broader literature between these domains and mental health problems: education level,[18] smoking and tobacco chewing,[19] alcohol consumption,[20] childhood adversity and family instability,[21,22] prewar traumatic events,[21,23] prior mental health symptoms,[18] and anger.[24]

In general, our scoring of RAP variables (e.g., summing of scale items) followed precedents set by the RAP developers over several years of prior analyses. To assess preservice smoking we used a RAP item asking "In the year before entering the military, did you smoke cigarettes?" We coded those responding, "not at all," as nonsmokers and those responding, "some days," or "every day," as smokers. Preservice tobacco chewing was defined by an affirmative response to the item "Did you use smokeless tobacco (dip, chew, snuff) 3 or more times during the past year?"

Preservice typical alcohol consumption was from the RAP question, "During the year (12 months) before entering the military, how often did you have a drink containing alcohol?" We coded those who responded "never" or "once/twice" as low alcohol consumers and those who responded "daily," "weekly," or "monthly" as high consumers. Preservice binge drinking was assessed with a RAP item asking "During the past year, how often did you have 6 or more drinks at one sitting? Response options were "never," "once/twice," "a few times," "daily," "weekly," and "monthly." We coded those who responded "never" as low on binge drinking and all others as high on binge drinking.

Preservice lifetime trauma was coded as present if the respondent endorsed any of the following: "You were in an accident where you could have been killed but were not badly hurt," "You were in an accident where you were injured and had to spend at least one night in the hospital," "You saw a close family member or friend being badly injured or killed," "You saw a stranger being badly injured or killed," "You were seriously attacked, beaten up, or assaulted," "You were threatened with a knife, gun, club, or other weapon," or "You were raped (someone forced you to have sex against your will)."

Preservice family conflict was based on the following RAP items: "While you were growing up, before age 17, how often did a parent or other adult living in your home: (1) Swear at you, insult you, or put you down?; (2) Push, grab, shove, slap, or throw something at you?; (3) Push, grab, shove, slap, or throw something at each other?" Response options were, "never," "once/twice," "sometimes," "often," and "very often," corresponding to a zero- to four-point scale. Responses to the 3 items were summed, and preservice family conflict was coded as low given a sum of <2, and high given a sum of ≥2. An additional variable, preservice family problems, was coded as high if the person endorsed one or both of the following: "While you were growing up, before age 17, (1) Did you live with someone who was depressed or mentally ill?; (2) Did you live with someone who was a problem drinker or alcoholic? (yes/no)." This variable was coded as low for individuals who endorsed neither item.

Assessment of preservice anger was based on the RAP item: "Do you sometimes get mad enough to hit, kick, or throw things?" Individuals responding, "never," or "about once a year," were coded as low and individuals responding, "about once a month," "about once a week," or "more than once a week," were coded as high.

A preservice mental health index was created from four RAP items derived from the MHI-5.[25] How much time in the past year: "Did you feel calm and peaceful?"; "Did you feel downhearted and blue?"; "Have you been a very nervous person?"; "Have you felt so down in the dumps nothing could cheer you up?" Response options were "none of the time," "a little of the time," "some of the time," "most of the time," and "all of the time," corresponding to a one- to five-point scale. We coded preservice mental health as high when responses to the 4 items summed to ≥8.

Education level came from a RAP item asking, "What is the furthest you've gone in school?" Based on military research linking lack of a high school diploma with adverse outcomes, education level was dichotomized into two categories (high school graduate vs. non-high-school graduate).

### Post-Deployment Health Assessment (PDHA) Form

The PDHA form (DD Form 2796) is a brief (4-page) self-report questionnaire that assesses demographics, deployment-related experiences and exposures, medical visits, health problems, and somatic symptoms experienced during the deployment. Completed PDHAs are kept in service members' permanent medical records, and electronic copies of all PDHAs are maintained by the Army Medical Surveillance Activity (AMSA).

The following PDHA variables were included as predictors: age at time of PDHA completion, paygrade at time of PDHA completion, frequency of sick calls during deployment,

overnight hospitalization during deployment, and reporting of worsening health during the deployment. In addition, several multiple-item scales were constructed from PDHA responses. A 3-item scale asked about combat experiences (e.g., "Did you see anyone wounded, killed, or dead during this deployment") and a 2-item scale asked about postdeployment interpersonal concerns related to conflict (e.g., "Are you having thoughts or concerns that you might hurt or lose control with someone?"). Another scale was the sum of the 21 somatic symptom items (e.g., "frequent indigestion" and "headaches"). A depression scale was created from 3 items that assessed depression (e.g., "Having little interest or pleasure in doing things"). Finally, a PTSD symptom scale was created from 4 yes/no PTSD symptom items on the PHDA (e.g., "Felt numb or detached from others, activities, or your surroundings") and was coded as present if 2 or more of the 4 items were endorsed.[26] With the exception of the PTSD symptom scale, all scale variables were dichotomized at the median of each distribution and respondents were classified as low or high. If Marines had multiple PDHA forms on file, the most recent form was used.

*Career History Archival Medical and Personnel System (CHAMPS)*

Data on Marines' career and medical histories were obtained from the CHAMPS database. CHAMPS is an electronic database maintained by the Naval Health Research Center (NHRC) in San Diego, which contains personnel and medical information on all military personnel.[27]

The following predictor variables were obtained from CHAMPS: age at enlistment, race (white, Hispanic, or other), number of total combat deployment days, and score on the Armed Forces Qualification Test (AFQT), a cognitive aptitude test taken before entry into the military.[28]

Outcome measures were also obtained from CHAMPS. Participants were defined as having a psychiatric disorder if they had an outpatient or hospitalization record during the observation period that included an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic code ranging from 290 to 316.[29] For service members diagnosed with more than one mental disorder, only the first diagnosis in the person's record was included in analyses to identify predictors of overall psychiatric disorders. CHAMPS also provided participant information on dates and locations for all deployments, discharge versus retention status, and for those who were discharged, the date of military discharge.

### Creation of the Study Database

Since June 2001, four different versions of the RAP survey have been in use. RAP 1 was given from June 2001 until June 2002, and then the first of several questionnaire modifications were made. The three most recent versions of RAP (RAP 2, 3, and 4) have been very similar in content; we selected only individuals who had completed RAP versions 2, 3, or 4 for our study.

An archival set of RAP records was extracted for all active duty enlisted Marines who entered basic training between June 2002 and September 2004, and the social security numbers (SSNs) for this sample were cross-referenced with the PDHA database maintained by AMSA.[30] A matched sample of 7,340 individuals with both RAP and PDHA data were then cross-referenced with personnel and medical data from CHAMPS. (Only 22% of RAP records selected for the study also had PDHAs. This was because the rate of PDHA completion in the Marine Corps was fairly low, and not all participants deployed during the time period our study focused on).

Because the objective of the study was to determine predictors of mental health disorders that emerged after combat deployment, we excluded Marines who received a psychiatric diagnosis before first deployment, along with Marines who never deployed, and Marines who deployed but not to a combat zone (e.g., Guantanamo Bay). This resulted in a sample of 6,442 Marines who had deployed to Iraq, Afghanistan, Qatar, or Kuwait.

### Description of Sample

Demographic characteristics of the sample are shown in Table I. Age at time of entry into the Marines ranged from 17 to 31 ($M = 19.4$, SD = 1.8). Most participants had a high school diploma (80.7%), 16.9% also had some college, and 2.4% were non-high-school graduates. The sample was predominantly white (65.1%) or Hispanic (22.9%), with small proportions of individuals from other ethnic groups (12.0%).

### Analysis

Cox proportional hazards regression (survival analysis) was used to determine the influence of preservice information from RAP,

**TABLE I.**   Characteristics of the Study Sample

| Study Sample (N = 6,442) | |
|---|---|
| Age at military entry, years (M ± SD) | 19.4 ± 1.8 |
| Sex (% male) | 100% |
| Accession year | |
| 2002 | 49.2% |
| 2003 | 47.6% |
| 2004 | 3.2% |
| AFQT (mean ± SD) | 57.5 ± 17.9 |
| Race | |
| White | 65.1% |
| Hispanic | 22.9% |
| Other | 12.0% |
| Enlisted vs. officer (% enlisted) | 100% |
| Paygrade at time of PDHA | |
| E1–E2 | 12.5% |
| E3 | 77.5% |
| E4–E5 | 10.0% |
| Education | |
| Non-high-school graduate | 2.4% |
| High school graduate | 80.7% |
| Some college | 16.9% |
| Marital status | |
| Single/never married | 96.9% |
| Married/divorced/widowed | 3.1% |

AFQT, Armed Forces Qualification Test; PDHA, Post-Deployment Health Assessment.

end-of-deployment self-reports from the PDHA, and demographic predictor variables on occurrence of first psychiatric diagnosis. The observation period started at time of entry into the Marines (between June 2002 and September 2004) and continued until they either received a psychiatric diagnosis, were discharged from the military, died ($n = 25$), or until the observation period ended (January 1, 2006). The maximum follow-up time was 43 months (mean = 34, median = 33.8 months). Separate analyses were conducted to identify predictors of receiving (1) a psychiatric diagnosis of any kind, (2) a substance use disorder diagnosis, or (3) an anxiety disorder diagnosis, which includes PTSD. The latter two categories represented the most common diagnostic groups. Survival time (the time variable used in the survival analysis) was the length of time between starting basic training and (1) first psychiatric diagnosis, (2) substance use disorder diagnosis, or (3) an anxiety disorder diagnosis.

In the Cox proportional hazards models, all variables that were significant in the univariate analysis ($p < 0.05$) were entered into multivariate models. Regression diagnostics to evaluate pairwise correlations and variance inflation factors did not reveal substantial collinearity among the model variables. A stepwise method was used with an inclusion value of $p < 0.05$ and a removal value of $p > 0.10$.

## RESULTS

### Psychiatric Diagnoses

During the follow-up period, 6.8% of the study sample received a psychiatric diagnosis ($n = 441$) from a mental health provider using ICD-CM-9 codes. Although the majority (55.8%) of the 441 cases had just one psychiatric diagnosis, 17.5% had two diagnoses, 12.0% had three, and 14.7% had four or more. For individuals diagnosed with a mental disorder ($n = 441$), Table II shows the distribution of diagnoses received. The first column shows the distribution of initial (chronologically first) psychiatric diagnoses among all cases in the sample ($n = 441$). The second column shows the distribution of all unique psychiatric diagnoses for the same sample. The most common diagnoses were anxiety disorders, substance-related disorders, "other mental disorders," and mood disorders.

### Predictors of Overall Psychiatric Disorders

Overall, 18 of the 26 variables examined as predictors of any psychiatric diagnosis were significant in the univariate Cox regression analysis (Table III). The preservice variables with the strongest univariate associations with any psychiatric diagnosis were education, smoking, tobacco chewing, and lifetime trauma. The deployment variables with the strongest associations with psychiatric diagnosis were lower paygrade, being hospitalized overnight during the deployment, PTSD symptoms, and reporting concerns about hurting someone, losing control, or having serious conflicts with others.

Nine variables emerged as significantly predictive of any psychiatric diagnosis in the final multivariate model (Table IV).

**TABLE II.** Distribution of Psychiatric Diagnoses

| Diagnostic Category | Initial Diagnosis in 441 Cases[a] | All Diagnoses in 441 Cases[b] |
|---|---|---|
| All Mental Disorders (total) | 441 | 887 |
| Substance-Related Disorders (total) | 137 | 198 |
| Alcohol | 129 | 173 |
| Drug | 8 | 25 |
| Adjustment Disorders (total) | 44 | 82 |
| Mood Disorders (total) | 44 | 137 |
| Major depression | 10 | 38 |
| Bipolar disorder | 1 | 4 |
| Dysthymia | 5 | 21 |
| Depression, not otherwise specified | 27 | 69 |
| Other | 1 | 5 |
| Personality Disorders (total) | 9 | 47 |
| Psychotic Disorders (total) | 1 | 5 |
| Schizophrenia | 0 | 4 |
| Schizophreniform disorder | 0 | 0 |
| Brief psychotic disorder | 0 | 0 |
| Psychosis, not otherwise specified | 0 | 0 |
| Delusional or shared psychosis | 1 | 1 |
| Anxiety Disorders (total) | 91 | 210 |
| Panic disorder | 5 | 11 |
| Generalized anxiety disorder | 5 | 9 |
| Obsessive-compulsive disorder | 0 | 0 |
| Phobias | 0 | 1 |
| Acute stress | 6 | 22 |
| Posttraumatic stress disorder | 60 | 132 |
| Anxiety, not otherwise specified | 15 | 35 |
| Somatoform/Dissociative/Factitious Disorders (total) | 7 | 12 |
| Dissociative disorder | 0 | 1 |
| Factitious disorder | 0 | 0 |
| Conversion disorder | 6 | 7 |
| Somatoform disorder | 1 | 4 |
| Other Mental Disorders (total) | 108 | 196 |
| Organic conditions | 0 | 4 |
| Eating disorder | 0 | 2 |
| Unspecified mental disorder | 16 | 33 |
| Psychological factors, physical condition | 0 | 0 |
| All other | 92 | 157 |

[a]All initial diagnoses received by the 441 cases. [b]All unique diagnoses received by the 441 cases during the observation period.

With all other variables controlled for, Marines with lower paygrades at the time of PDHA completion were at substantially greater risk for a psychiatric diagnosis than higher paygrade Marines (hazard ratio [HR] = 6.62 for E1–E2 paygrade Marines, HR = 2.64 for E3 Marines). Other variables that were strong risk factors for receiving a mental disorder diagnosis included being hospitalized overnight during deployment (HR = 2.01), lower education level (HR = 1.91), preservice smoking (HR = 1.75), and PTSD symptoms (HR = 1.65). Additional variables that were significantly associated with the development of mental disorders included

**TABLE III.** Univariate Cox Proportional Hazards Analysis of Predictors of Psychiatric Disorders Among Deployed Marines (*N* = 6,442)

| Variable | HR | 95% CI |
|---|---|---|
| Preservice Variables | | |
| AFQT: | | |
| Low (reference; <50) | 1.38** | 0.14–1.66 |
| High (≥50) | 1.00 | |
| Accession Age, Years: | | |
| 17–18 (reference) | 1.00 | |
| 19 | 1.07 | 0.86–1.34 |
| 20 | 1.34 | 1.00–1.81 |
| ≥21 | 1.17 | 0.89–1.55 |
| Race: | | |
| White (reference) | 1.00 | |
| Hispanic | 0.78* | 0.62–0.99 |
| Other | 0.91 | 0.67–1.23 |
| Education: | | |
| High school graduate (reference) | 1.00 | |
| Non-high-school graduate | 2.62** | 1.74–3.96 |
| Preservice Smoking: | | |
| Nonsmoker | 1.00 | |
| Smoker | 1.92** | 1.59–2.32 |
| Tobacco chewing: | | |
| Nonchewer (reference) | 1.00 | |
| Chewer | 1.54** | 1.23–1.91 |
| Typical Alcohol Consumption: | | |
| Low (reference) | 1.00 | |
| High | 1.27* | 1.05–1.54 |
| Binge Drinking: | | |
| Low (reference) | 1.00 | |
| High | 1.21 | 1.00–1.47 |
| Lifetime Trauma (scale): | | |
| None (reference) | 1.00 | |
| One or more preservice traumas | 1.44** | 1.19–1.74 |
| Family Conflict (scale): | | |
| Low (reference) | 1.00 | |
| High | 1.29* | 1.06–1.56 |
| Family Problems (scale): | | |
| Low (reference) | 1.00 | |
| High | 1.40** | 1.10–1.78 |
| Anger: | | |
| Low (reference) | 1.00 | |
| High | 1.02 | 0.81–1.29 |
| Mental Health (scale): | | |
| Low | 1.08 | 0.89–1.31 |
| High (reference) | 1.00 | |
| Postdeployment Variables | | |
| Number of Total Combat Deployment Days: | | |
| ≤220 days (reference) | 1.00 | |
| >220 days | 0.87 | 0.73–1.05 |
| Age at Time of PDHA, Years: | | |
| 18 | 1.00 | |
| 19 | 0.76 | 0.46–1.27 |
| 20 | 0.46** | 0.28–0.76 |
| ≥21 | 0.47** | 0.29–0.77 |
| Paygrade at Time of PDHA: | | |
| E1–E2 | 6.80** | 4.23–10.92 |
| E3 | 2.66** | 1.69–4.18 |
| E4–E5 (reference) | 1.00 | |
| Combat Exposure (scale): | | |
| Low (reference) | 1.00 | |
| High | 1.29** | 1.07–1.56 |

**TABLE III.** Continued

| Variable | HR | 95% CI |
|---|---|---|
| Depression (scale): | | |
| Low (reference) | 1.00 | |
| High | 1.43** | 1.19–1.73 |
| PTSD Symptoms (scale): | | |
| Low (reference) | 1.00 | |
| High | 2.07** | 1.66–2.59 |
| Somatic Symptoms (scale): | | |
| Low (reference) | 1.00 | |
| High | 1.19 | 0.99–1.44 |
| Health Worsened during Deployment: | | |
| No (reference) | 1.00 | |
| Yes | 1.73** | 1.34–2.24 |
| Number of Times to Sick Call during Deployment: | | |
| None (reference) | 1.00 | |
| One or more sick-call visits | 1.65** | 1.34–2.01 |
| Hospitalized Overnight during Deployment: | | |
| No (reference) | 1.00 | |
| Yes | 2.69** | 1.97–3.66 |
| Concerns about Hurting Someone, Losing Control, or Serious Conflicts with Others (scale): | | |
| None (reference) | 1.00 | |
| One or more concerns | 2.06** | 1.64–2.60 |

HR, hazard ratio; CI, confidence interval; AFQT, Armed Forces Qualification Test; PDHA, Post-Deployment Health Assessment; PTSD, posttraumatic stress disorder.
*$p < 0.05$; **$p < 0.01$.

end-of-deployment concerns about hurting someone, losing control, or having serious conflicts with others (HR = 1.55), the number of times the participant went to sick call during deployment (HR = 1.43), preservice lifetime trauma (HR = 1.32), and lower AFQT score (HR = 1.26).

## Predictors of Substance-Related Disorders and Anxiety Disorders

Separate Cox regression models were constructed for the two most common specific diagnoses in the sample: substance use disorders and anxiety disorders. Participants who received either a substance use disorder diagnosis (*n* = 188) and/or an anxiety disorder diagnosis (*n* = 161) during the observation period were compared with participants with no mental disorder diagnosis.

Three predictors had significant associations with substance use disorders in the multivariate model: lower paygrade at time of PDHA (HR = 13.85 for E1–E2 paygrade Marines, HR = 3.72 for E3 Marines), preservice smoking (HR = 2.83), and postdeployment PTSD symptoms (HR = 2.04) (Table IV). Seven variables were significant in predicting anxiety disorders: lower paygrade at time of PDHA completion (HR = 6.95 for E1–E2 paygrade Marines, HR = 3.01 for E3 Marines), lower education level (HR = 3.47), postdeployment PTSD symptoms (HR = 3.05), being hospitalized overnight during deployment (HR = 2.01), lower AFQT score (HR = 1.64),

**TABLE IV.** Multivariate Cox Proportional Hazards Analysis of Predictors of Psychiatric Disorders Among Deployed Marines

| Variable | All Psychiatric Disorders $N = 6,442$ | | Substance Use Disorders $N = 6,189$ | | Anxiety Disorders $N = 6,162$ | |
|---|---|---|---|---|---|---|
| | HR | 95% CI | HR | 95% CI | HR | 95% CI |
| Preservice Variables: | | | | | | |
| AFQT (low) | 1.26* | 1.04–1.53 | — | | 1.64** | 1.19–2.25 |
| Education (non-high-school graduate vs. graduate) | 1.91** | 1.26–2.89 | — | | 3.47** | 2.03–5.95 |
| Preservice smoking | 1.75** | 1.44–2.12 | 2.83** | 2.10–3.80 | 1.60** | 1.17–2.20 |
| Lifetime trauma | 1.32** | 1.09–1.60 | — | | — | |
| Postdeployment Variables: | | | | | | |
| Paygrade at time of PDHA | | | | | | |
| E1–E2 | 6.62** | 4.01–10.93 | 13.85** | 5.57–34.45 | 6.95** | 2.92–16.53 |
| E3 | 2.64** | 1.64–4.26 | 3.72** | 1.52–9.12 | 3.01** | 1.32–6.87 |
| E4–E5 (reference) | 1.00 | | 1.00 | | 1.00 | |
| PTSD symptoms | 1.65** | 1.28–2.12 | 2.04** | 1.43–2.90 | 3.05** | 2.17–4.30 |
| Number of times to sick call during deployment (0 vs. ≥1) | 1.43** | 1.16–1.77 | — | | 1.64** | 1.17–2.30 |
| Hospitalized overnight during deployment | 2.01** | 1.45–2.80 | — | | 2.01** | 1.21–3.34 |
| Concerns about hurting someone, losing control, or serious conflicts with others | 1.55** | 1.15–2.09 | — | | — | |

Dashes indicate that variable was not retained in the final model because it was not statistically significant. Because of missing data, sample sizes for the final multivariate models were 6,117 for the all psychiatric disorder model, 6,153 for the substance use disorder model, and 6,082 for the anxiety disorder model. HR, hazard ratio; CI, confidence interval; AFQT, Armed Forces Qualification Test; PDHA, Post-Deployment Health Assessment; PTSD, posttraumatic stress disorder.
*$p < 0.05$; **$p < 0.01$.

number of visits to sick call during deployment (HR = 1.64), and preservice smoking (HR = 1.60).

### Paygrade and Demotions

Lower paygrade at time of PDHA completion was the strongest predictor of psychiatric diagnoses overall. To look more closely at the paygrade reduction issue and to determine if demotions accounted for the presence of some unexpectedly low paygrades in the sample, we conducted a follow-on extract of official DoD pay records to create a new dichotomous variable for each member of the study sample, indicating presence or absence of a reduction in paygrade. The paygrade reduction variable correlated −0.23 ($p < 0.001$) with paygrade at time of PDHA, indicating that, as expected, Marines with demotions had significantly lower end-of-deployment paygrades. Interestingly, we found that almost a third of the Marines with a psychiatric diagnosis had received a reduction in paygrade (31.5%), compared with only 8.0% of Marines not receiving a psychiatric diagnosis, $\chi^2(6,441) = 260.4$, $p < 0.001$. Marines with a psychiatric disorder were about four times as likely to have been demoted compared with Marines without a diagnosed disorder. About half of the reductions in paygrade occurred subsequent to psychiatric diagnosis and the remaining occurred before diagnosis.

### DISCUSSION

Most epidemiologic studies of combat-related mental disorders have relied heavily on retrospective accounts of important predictor variables such as early life events, prior levels of psychological distress, and war zone experiences occurring many years earlier. However, there is strong evidence that memory biases may confound the information recalled by war veterans and other traumatized groups. This study is unique in its use of predictor data obtained both before and shortly after combat deployment.

In our sample of 6,442 Marines with no prior psychiatric problems, 6.8% ($n = 441$) were diagnosed with a postdeployment psychiatric disorder during the observation period. The key risk factors for psychiatric disorders were low paygrade, hospitalization during deployment, low education, preservice smoking, PTSD symptoms endorsed on the PDHA, interpersonal concerns related to conflict, sick call visits in the war zone, premilitary life history of trauma, and relatively lower intelligence (AFQT score). Although these findings are associational rather than causal, they have important implications for identifying personnel at risk for future mental health problems.

Although there is extensive evidence that war zone combat exposures are predictive of psychiatric disorders (perhaps in a dose-response relationship)[31] we did not find a relationship between combat exposures (e.g., seeing others wounded, killed, or dead) and psychiatric diagnoses in the final multivariate model predicting psychiatric diagnoses. One possible explanation is that the government's postdeployment screening form (PDHA) has far fewer combat exposure questions than surveys designed by researchers to assess the impact of combat. Specifically, the PDHA contains only 3 items that assess combat exposures. We recommend that the PDHA be thoroughly reevaluated and that the combat exposure section of this form be expanded. Expanding the combat exposure

section of the PDHA could enhance the military's ability to identify and refer personnel at risk for psychiatric sequelae.

Our results also indicate that the military's PDHA-based clinical referral policies may require re-examination. Specifically, although current DoD policy dictates clinical referral for service members who endorse two out of the four PTSD questions on the PDHA, our data indicate that additional PDHA variables are predictive of psychiatric disorders. Hospitalizations and sick call visits during deployment and concerns about hurting others were also significant risk factors for mental health problems. Results of the present study could be used to lay the groundwork for an algorithm-driven approach that better utilizes the PDHA for referral purposes.

Substance abuse disorders and anxiety disorders were the most prevalent diagnostic subtypes in the present sample. Predictors of anxiety disorders closely paralleled the predictors for overall psychiatric disorders. Substance abuse disorders, however, were only related to three predictors: low paygrade, smoking, and PTSD symptoms endorsed on the PDHA.

We also found that the strong association between low paygrade and psychiatric diagnoses was influenced by the relatively high rate of demotions in diagnosed Marines. Marines with a psychiatric diagnosis were four times more likely than their peers to have been demoted. Since psychological and behavioral problems often go hand in hand,[32,33] we hypothesize that there is a proclivity in some individuals with psychiatric symptoms to engage in misconduct. Discussions with Marine officials revealed that paygrade reductions are sometimes done as disciplinary actions targeted at Marines who have exhibited misconduct, such as unauthorized absences or alcohol-related offenses. Further analysis of this issue is clearly needed.

The limitations of this study should be mentioned. First, because the study only included Marines who attended basic training in San Diego (which is where the RAP was given) and who also had a completed PDHA on file, our sample may not have been entirely representative of the male Marine Corps population. Second, nearly all of the postdeployment variables that emerged as significant "predictors" of subsequent diagnoses could themselves be manifestations of ongoing psychiatric morbidity. In addition, the questionnaires from which we drew our data asked for names and SSNs. Because service members were identified, it is likely that some degree of underreporting affected our data. As stated earlier, our findings are associational rather than causal. An additional limitation is that different Marine Corps units may have different practices with regard to the variables reported here (e.g., diagnoses and demotions). A final limitation of the study is our lack of access to diagnoses assigned during combat deployments. Further work is planned to study service members who receive psychiatric care in the war zone.

However, the unique strengths of this study are substantial. Specifically, longitudinal studies of military mental disorders are extremely rare and collecting combat exposure and mental health data immediately after deployment may have minimized exaggeration of combat exposures and mental disorder symptoms. In addition, many previous studies are confounded by a failure to identify service members with pre-existing psychiatric conditions; these members were identified and removed from the present study sample to increase the clarity of results.

In conclusion, the present study found that risk factors for postdeployment psychiatric disorders consisted of both pre-service variables and war zone variables. The impact of combat exposure was smaller than expected, possibly because the PDHA does not adequately assess this domain. The study's findings highlight the need for a revised version of the PDHA that fully assesses the combat experiences of service members. Finally, the association between psychiatric diagnoses and demotions merits additional scrutiny.

## REFERENCES

1. Buydens-Branchey L, Noumair D, Branchey M: Duration and intensity of combat exposure and posttraumatic stress disorder in Vietnam veterans. J Nerv Ment Dis 1990; 178: 582–7.
2. Donovan BS, Padin-Rivera E, Dowd T, Blake DD: Childhood factors and war zone stress in chronic PTSD. J Trauma Stress 1996; 9: 361–8.
3. Green MA, Berlin MA: Five psychosocial variables related to the existence of post-traumatic stress disorder symptoms. J Clin Psychol 1987; 43: 643–9.
4. Helmus TC, Glenn RW: Steeling the Mind: Combat Stress Reactions and Their Implications for Urban Warfare. Arlington, VA, RAND Corporation, 2005.
5. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL: Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. N Engl J Med 2004; 351: 13–22.
6. Koenen KC, Stellman JM, Stellman SD, Sommer JF Jr: Risk factors for course of posttraumatic stress disorder among Vietnam veterans: a 14-year follow-up of American Legionnaires. J Consult Clin Psychol 2003; 71: 980–6.
7. Wolfe J, Erickson DJ, Sharkansky EJ, King DW, King LA: Course and predictors of posttraumatic stress disorder among Gulf War veterans: a prospective analysis. J Consult Clin Psychol 1999; 67: 520–8.
8. Roemer L, Litz BT, Orsillo SM, Ehlich PJ, Friedman MJ: Increases in retrospective accounts of war-zone exposure over time: the role of PTSD symptom severity. J Trauma Stress 1998; 11: 597–605.
9. Safer MA, Keuler DJ: Individual differences in misremembering pre-psychotherapy distress: personality and memory distortion. Emotion 2002; 2: 162–78.
10. Southwick SM, Morgan CA, Nicolaou AL, Charney DS: Consistency of memory for combat-related traumatic events in veterans of Operation Desert Storm. Am J Psychiatry 1997; 154: 173–7.
11. Candela I, Merckelbacha H: Peritraumatic dissociation as a predictor of post-traumatic stress disorder: a critical review. Compr Psychiatry 2004; 45: 44–50.
12. Constans JI: Information-processing biases in PTSD. In: Neuropsychology of PTSD: Biological, Cognitive, and Clinical Perspectives, pp 105–130. Edited by Vasterling JJ, Brewin CR. New York, Guilford Press, 2005.
13. Ware J, Sherbourne C: The MOS 36-Item Short-Form Health Survey (SF-36): I. Conceptual framework and item selection. Med Care 1992; 30: 473–83.

14. Anda RF, Croft JB, Felitti VJ, et al: Adverse childhood experiences and smoking during adolescence and adulthood. JAMA 1999; 282: 1652–8.
15. Dube SR, Anda RF, Felitt VJ, Edwards VJ, Croft JB: Adverse childhood experiences and personal alcohol abuse as an adult. Addict Behav 2002; 27: 713–25.
16. Straus M, Gelles RJ: Physical Violence in American Families: Risk Factors and Adaptations to Violence in 8,145 Families. New Brunswick, NJ, Transaction Press, 1990.
17. Babor TF, Biddle-Higgins JC, Saunders JB, Monteiro MG: AUDIT: The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Health Care. Geneva, Switzerland, World Health Organization, 2001.
18. Brewin CR, Andrews B, Valentine JD: Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. J Consult Clin Psychol 2000; 68: 748–66.
19. Van der Velden PG, Grievink L, Oliff M, Gersons GPR, Kleber RJ: Smoking as a risk factor for mental health disturbances after a disaster: a prospective comparative study. J Clin Psychol 2007; 68: 87–92.
20. Acierno R, Resnick H, Kilpatrick DG, Saunders B, Best CL: Risk factors for rape, physical assault, and posttraumatic stress disorder in women: examination of differential multivariate relationships. J Anxiety Disord 1999; 13: 541–63.
21. O'Toole BI, Marshall RP, Schureck RJ, Dobson M: Risk factors for post-traumatic stress disorder in Australian Vietnam veterans. Aust N Z J Psychiatry 1998; 32: 21–31.
22. Gahm GA, Lucenko BA, Retzlaff P, Fukada S: Relative impact of adverse events and screened symptoms of posttraumatic stress disorder and depression among active duty soldiers seeking mental health care. J Clin Psychol 2007; 63: 199–211.
23. Solomon Z: The effect of prior stressful experience on coping with war trauma and captivity. Psychol Med 1995; 25: 1289–94.
24. Chemtob CM, Hamada RS, Roitblat HL, Muraoka MY: Anger, impulsivity, and anger control in combat-related posttraumatic stress disorder. J Consult Clin Psychol 1994; 62: 827–32.
25. Berwick DM, Murphy JM, Goldman PA, Awre JE Jr, Barsky AJ, Weinstein MC: Performance of a five-item mental health screening test. Med Care 1991; 29: 169–76.
26. Bliese PD, Wright KM, Thomas JL, Adler AB, Hoge CW: Postdeployment mental health screening instruments: how good are they? Paper presented at the annual meeting of the Army Science Conference, Orlando, FL, November 2005.
27. Gunderson EKE, Garland CF, Miller MR, Gorham ED: Career History Archival Medical and Personnel System. Milit Med 2005; 170: 172–5.
28. Orme DR, Brehm W, Ree MJ: Armed Forces Qualification Test as a measure of premorbid intelligence. Mil Psychol 2001; 13: 187–97.
29. ICD-9-CM 2006: International Classification of Diseases, 9th Revision, Clinical Modification, Hospital Ed, Vols 1–3. Los Angeles, CA, Practice Management Information Corporation, 2005.
30. Army Medical Surveillance Activity: Update: pre- and postdeployment health assessments, US Armed Forces, January 2003–October 2005. MSMR 2005; 11(5): 12–7.
31. Dohrenwend BP, Turner JB, Turse NA, Adams BG, Koenen KC, Marshall R: The psychological risks of Vietnam for U.S. veterans: a revisit with new data and methods. Science 2006; 313: 979–82.
32. Hodgins S, Mednick SA, Brennan PA, Schulsinger F, Engberg M: Mental disorder and crime: evidence from a Danish birth cohort. Arch Gen Psychiatry 1996; 53: 489–96.
33. Rachbeisel J, Scott J, Dixon L: Co-occurring severe mental illness and substance use disorders: a review of recent research. Psychiatr Serv 1999; 50: 1427–34.

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**14. ABSTRACT**

The objective of this prospective cohort study was to identify risk factors for combat-related psychiatric disorders. The sample consisted of 6,442 enlisted U.S. Marines who completed a questionnaire during basic training, deployed to a combat zone, and completed a postdeployment questionnaire. Survival analysis was used to determine associations between predeployment and postdeployment self-reports and subsequent mental health outcomes. During the 43-month observation period, 6.8% of the sample were diagnosed with a psychiatric disorder. The strongest predictors of postdeployment psychiatric disorders were, in order of importance, low paygrade, hospitalization during deployment, low education, smoking, and posttraumatic stress disorder symptoms at deployment's end. The impact of war zone variables was smaller than expected, possibly due to limitations in the postdeployment screening form used to assess combat exposures.

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